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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/913,960 | 08/21/2001 | Yuji Kanno | 21900/0035 | 8017 |

7590 12/17/2003

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| EXAMINER | |
|---|---|
| TO, BAOQUOC N | |
| ART UNIT | PAPER NUMBER |
| 2172 | |

DATE MAILED: 12/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/913,960 | KANNO, YUJI | |
| | Examiner | Art Unit | |
| | Baoquoc N To | 2172 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 2 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☒ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-29* is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☒ Claim(s) *1-29* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

## DETAILED ACTION

1. The applicant representative called the Office on 11/21/2003 regarding to missing claims in the Ex Parte Quayle Office Action dated 10/27/03. The Office corrects the missing claimed as the applicant representative pointed out. The Office appreciates the courtesy call.

2. This application is in condition for allowance except for the following formal matters:

a). The preamble of claims 1-2 and 15-16 state the preparation of mechanically searchable index; however the preamble do not state the use of preparation of mechanically searchable index. Appropriate correction is required.

b). The term mechanically searchable index does not have support in the specification. The applicant specification only support searchable index not mechanically searchable index. Appropriate correction is required.

c). For claims 10 and 23 please remove or make this into the claim body ("hereafter referred to as "partial inner product") and as for same for the claims 11 and 14 please remove or make this into the claim body (i.e., square of Euclidean distance, hereafter referred to as "partial square distance").

Prosecution on the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

A shortened statutory period for reply to this action is set to expire **TWO MONTHS** from the mailing date of this letter.

***Allowable Subject Matter***

3. Claim 1-9 and 15-22 are allowed.

a. Claims 1 and 15 are allowed by the following reason.

The following is a statement of reasons for the indication of allowable subject matter: None of the prior arts in singly or in combination teach or suggest dividing N component into m sets in a predetermined method with respect to the N-dimensional real vector V of each vector data in said vector database, preparing m partial vectors V1 to Vm, subsequently tabulating a distribution of norm of the partial vector Vk (k = 1 to m), preparing norm division table in which a norm range of a predetermined D type norm division is determined, calculating a region number of d to which said partial vector Vk belongs in accordance with predetermined D region center vector p1 to pd, tabulating a distribution of a cosine (Vk*Pd)/(|Vk| * |Pd|) of an angle formed by said partial vector Vk and the region Center Vector Pd as a declination distribution, and preparing a declination division table in which a declination range of the predetermined C type declination division record; and search object range generation means for calculating a partial space number b, and a set (c, [r1, r2]) of a declination division number c to be search in a region number d and a norm division range [r1, r2] from the value of an inner product pd *qb of the region center vector pd and said partial query vector qb, said partial inner product lower limit value fb, and a norm division table and a declination division table in said vector index with respect to each partial query vector qb (b = 1 to m) and each region b.

b. Claims 2-9 and 16-22 are allowed by the following reason.

The following is a statement of reasons for the indication of allowable subject matter: None of the prior arts in singly or in combination teach or suggest partial vector calculation means for dividing N components into m sets in a predetermined method with respect to the N-dimensional real vector V of each vector data in said sector database, and preparing m partial vectors v1 to vm; norm distribution tabulation means for tabulating a distribution of a norm of the partial vector vk (k = 1 to m) among said prepared m partial vector v1 to m , and preparing a norm division table in which a norm range of a predetermined D type norm division is determined; region number calculation a region number d to which said partial vector vk belong in accordance with predetermined D region center vectors p1 to pb; declination distribution means for tabulating a distribution of a cosine (vk *pd) / (|vk| * |pd|) of an angle formed by said partial vector vk and the region center vector pd as a declination distribution, and preparing a declination division table in which a declination range of the predetermined range of the predetermined c type declination division is recorded; norm division number calculation means for referring to said norm division table to calculate a number r of the norm division to which the norm of said partial vector vb belongs with respect to the partial vector vb (b = 1 to m) for the partial space number b among the m partial vectors v1 to vm prepared by said partial vector calculation means; declination division number calculation means for calculating a declination (vb * pd)/ (|vb| * |pd|) as a cosine of an angle formed by said partial vector vb and the region of said region number d

indicating a center direction of the region of said region number d calculated by said region number calculation means; index data calculation means for calculating index registration data to be registered in a vector index from said partial space number b, said region number d, said declination division number c, said norm division number r, the component of said partial vector vb, and the identification number I; and

Index constituting means for constituting means for constituting the vector index such that the identification number and the component of each partial vector can be searched using a set of the partial space number b, the region number d, the declination division number c and a norm division number range [r1, r2] as key from said norm division table, said declination division table, and said index registration data, and such that the vector component of teach vector data can be searched with the identification number of the vector component.

4. Claims 10-14 and 23-29 are allowed.

a. Claims 10 and 23 are allowed by the following reason.

The following is a statement of reasons for the indication of allowable subject matter: None of prior art singly or in combination neither teach or suggest "a first step of similar vector search of dividing N component of Q into a m sets in the same predetermined method as a method used in preparing said vector index with respect to said query vector Q, preparing m partial query vector q1 to qm, calculating a partial inner product lower limit value fb as a lower limit value of inner product (hereafter referred to as "partial inner product) of each partial query vector qb and the

corresponding partial vector from a designated inner product lower limit value $\alpha$ , calculating a partial space number b, and a set (c, [r1, r2]) of a declination division number c to be searched in a region number d and a norm division range [r1, r2] from a value of an inner product pd *qb of the region center vector pd and said partial query vector qb, said partial inner product lower limit value fb, and a norm division table and a declination division table in said vector index with respect to each partial query vector qb (b = 1 to m) and each region b, searching range of said vector index using (b, d, c, [r1, r1] as a search condition based on said calculated (c, [r1, r2]), obtaining the identification number i and the component of the partial vector vb satisfying the condition as an index search result, calculating a partial inner product difference (vb*qb)-fb as a different between partial inner product vb*qb of said vb and qb and said partial inner product lower limit value fb, and accumulating (adding) the difference as an inner product difference upper limit value S[i] of the identification number i of an inner product different table; and second step of the similar vector search of searching said vector index with the identification number i in order from a largest value in said inner product difference table S[i] to obtain a vector data component V, calculating an inner product difference value t = V*Q-$\alpha$ by subtracting $\alpha$ from the inner product V*Q of V and said query vector Q, and outputting a set of at least the identification i and an inner product t + $\alpha$ as a search result with respect to L pieces at maximum of vector data with a large inner product difference value when L or more pieces of vector data having inner product difference value larger than a maximum value of an element having a non-calculated inner product difference value are collected, or when the inner products

of all the vector data having a positive inner product difference upper limit value are calculated in said inner product difference table."

b. Claims 11-14 and 24-29 are allowed by the following reason.

The following is a statement of reasons for the indication of allowable subject matter: None of prior art singly or in combination neither teach or suggest "a first step of similar vector search of dividing N components of Q into m sets in the same predetermined method as a method used in preparing said vector index with respect to said query vector Q, preparing m partial query vector q1 to qm, calculating a partial spare distance upper limit value fb as an upper limit value of a square distance |vb-qb|2 (i.e., square of Euclidean distance, hereinafter referred to as "spatial square distance") of each partial query vector qb and the corresponding partial vector vb from a designated distance upper limit value $\alpha$ , systematically generating a set (b, d, c, [r1, r2]) of a partial space number b to be searched, a region number d, a declination division number c and a norm division range [r1, r2]) from said partial query vector qb, said partial square distance upper limit value fb, and a norm division table and a declination division table in said vector index with respect to each partial query vector qb (b = 1 to m), searching a range of said vector index using said generated (b, d, c, [r1, r2]) as a search condition, obtaining the identification number i and the component of the partial vector vb satisfying the condition as an index search result, calculating a partial square distance difference fb-[vb-qb]2 as a difference between said partial square distance upper limit value fb and a partial square distance [vb-qb]2 of vb and qb,

and accumulating (adding) the difference as a square distance difference upper limit value S[i] of the identification number i of a square distance difference table; and second step of the similar vector search of searching said vector index with the identification number i in order from a largest value in said square distance difference table S[i] to obtain a vector data component V, calculating a square distance difference value α 2-[V-Q]2 by subtracting a square distance [V-Q]2 of V and said query vector Q from a squared distance upper limit value α 2, and outputting a set of at least the identification number i and a distance (α 2-t)1/2 as a search result with respect to L pieces at maximum of vector data with a large square distance difference t when L or more pieces of vector data having the square distance difference value larger than a maximum value of an element having a non-calculated square distance difference value are collected, or when the square distance difference values of all the vector data having a positive square distance difference upper limit value are calculated in said square distance different table.

***Conclusion***

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

| | |
|---|---|
| Kubo et al. (US. Patent No. 4,837,632) | Patent date: 06/06/1989 |
| Fox et al. (US. Patent No. 6,574,632) | Patent date: 06/03/2003 |
| Corey et al. (US. Patent No. 5,987,446) | Patent date: 11/16/1999 |
| Takahashi et al. (US. Patent No. 5706,497) | Patent date: 06/06/1998 |
| Foote et al. (US. Patent No. 5,404,925) | Patent date: 06/11/2002 |

Kiyoki et al. (US. Patent No. 6,334,129) Patent date: 12/25/2001

Yazdani et al. (Non-Patent Littérature) 1994

A Framework For Feature-Based Indexing for Spatial Databases

White et al. (Non-Patent Littérature) 1996

Similarity Indexing with SS-tree

Kim et al. (Non-Patent Littérature) 04/06/2001

An Index-Based Approach for Similarity Search Supporting Time Warping in Large Sequence Databases.

Berchtold et al. (Non-Patent Littérature) 2001

Searching in High-Dimensional Spaces—Index structure for Improving the Performance of Multimedia Databases.

***Contact Information***

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Baoquoc N. To whose telephone number is (703) 305-1949 or via e-mail BaoquocN.To@uspto.gov. The examiner can normally be reached on Monday-Friday: 8:00 AM – 4:30 PM, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kim Y. Vu can be reached at (703) 305-4393.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks
Washington, D.C. 20231.

The fax numbers for the organization where this application or proceeding is assigned are as follow:

- (703) 746-7238 [After Final Communication}]
- (703) 746-7239 [Official Communication]
- (703) 746-7240 [Non-Official Communication]

Hand-delivered responses should be brought to:

Crystal Park II
2121 Crystal Drive
Arlington, VA 22202
Fourth Floor (Receptionist).

Baoquoc N. To
Dec 11, 2003

KIM VU
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100